Tailoring Multimedia Instruction to Soldier Needs

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ABSTRACT

To address particular learning needs, instruction should be designed to provide the right information to the right learner at the right time. While interactive multimedia instruction can reach a large audience, different learners have different learning needs. In this research, three questions were addressed: (a) how could existing Army interactive multimedia instruction (IMI) be modified to a needs-based format, (b) what types of instructional design techniques could be applied to design IMI for learners' specific needs, and (c) what outcomes are associated with different types of needs-focused IMI? Following a survey of existing Combat Arms IMI, it appeared that most would require modification for reuse in a needs-based context. Six IMI exemplars were developed for two topics (i.e., Adjust Indirect Fire and Conduct a Defense by a Squad) targeting the learning needs of new squad or team leaders. The IMI were developed for three needs-focused conditions to test whether learners with differing levels of prior knowledge and experience performed better with different types of IMI. One condition was tailored training, and the other two were not tailored, and were designated as familiarization and core/refresher training. The exemplars were tested with Soldiers attending the Warrior Leader Course at Fort Benning. In all conditions, Soldiers showed higher test scores after training. However, for the less familiar topic, the greatest impact was found for the tailored training condition over non-tailored familiarization and core/refresher training. The familiar topic showed no differences among needs-based conditions. These results indicated that structure is necessary for novel material to mimic what learners naturally do with familiar material. To effectively modify IMI to a needs-based format, one needs to define the learning needs of the specific audience up front and to structure the IMI to support individual choice and flexibility.

ABOUT THE AUTHORS

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INTRODUCTION

Dyer, Singh, and Clark (2005) found that Soldiers who were less experienced in a topic domain required training that was more structured than Soldiers who were more experienced, with the latter group benefiting from being able to exercise greater control over how and what they were learning. Soldiers in training embody a variety of educational backgrounds, professional experiences, and learning needs. From the perspective of the Army Learning Model (ALM), interactive multimedia instruction (IMI) is viewed as an essential tool to deliver instruction when, where, and how it is needed to support learner-centered and life-long learning initiatives (TRADOC, 2011). While IMI is able to reach a large audience, it may not always deliver instruction appropriate to the diverse knowledge and experience represented within that audience. The *when* and the *where* are questions of accessibility, whereas the *how* is a question that focuses on the needs of particular learners. Adaptive IMI has been developed to address the *how* question, but many existing examples were expensive and complex to develop, emphasizing high-bandwidth features. IMI must be designed to meet the needs of learners with varying levels of knowledge and experience, who may be seeking training in response to their unique job demands. Quite often it must do so in a way that can be easily applied by Army training developers and distributed to the Army. To address this problem, our research focused on (a) surveying existing Army Combat Arms IMI to determine whether and how it could be modified to needs-based formats, (b) identifying and applying instructional design techniques to develop IMI exemplars addressing specific learning needs, and (c) determining whether different types of needs-based IMI are associated with measurable learning outcomes among students with varying familiarity with the training domain.

Three types of needs-focused IMI designs were addressed, including two non-tailored variations (i.e., familiarization and core/refresher) and a tailored training variation. Familiarization focused broadly on a topic domain, enabling learners to form a coherent understanding of the domain but not going into great depth on any single topic. Core/refresher training focused specifically on a task and provided in-depth information on how to execute the task; there was much less breadth (or contextual) information provided. Finally, tailored training combined both breadth and depth of information into multiple, learner-selected learning paths. In the tailored condition, a diagnostic assessment with individualized feedback was also provided to learners before and after training to help inform their decision to pursue a particular learning path among those available. We hypothesized that learners in the tailored training IMI condition would benefit more than those in the non-tailored familiarization and core/refresher conditions, and that tailored training would most benefit learners in the less familiar than in the more familiar topic domain.

Overview of the Research Process

This research was conducted in multiple phases. In the first phase, we reviewed the literature and collected examples of existing Army IMI to evaluate whether and how existing Army IMI was addressing particular learning needs. Moreover, the central concern was whether existing IMI could be modified to be needs-focused format, i.e., targeting a particular audience with job-specific and individual learning requirements. The second phase was focused on developing IMI exemplars that would reflect an instructional design and content selection that was focused on the particular needs of squad/team leaders. The topic domain selected was Combat Arms (e.g., Infantry, Air Defense, Armor, Field Artillery) and the particular topics were *Adjust Indirect Fire* and *Conduct a Defense by a Squad*. Finally, the needs-focused IMI exemplars were developed and tested with Soldiers enrolled in the Warrior Leader Course (WLC) at Henry Caro Noncommissioned Officer Academy (NCOA) at Fort Benning, GA. Figure 1 provides an overview of the research process.

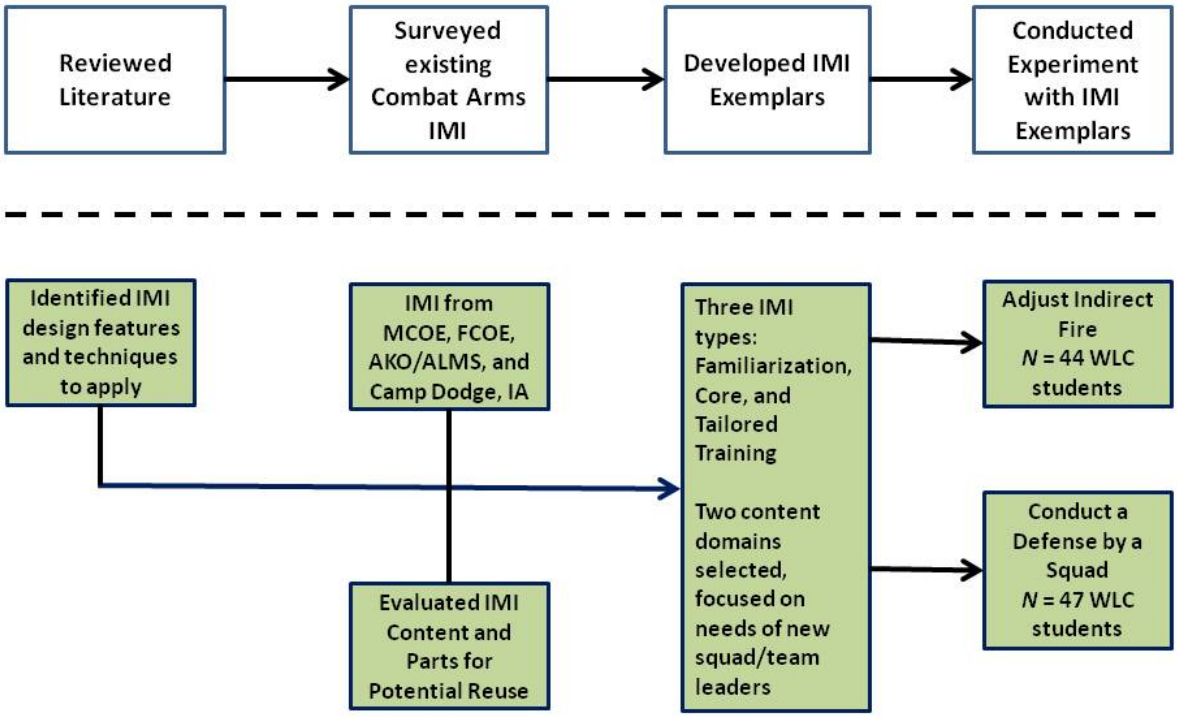

Figure 1. Overview of the Research Process.

INSTRUCTIONAL DESIGN

Published literature was reviewed to identify general features of good training design. Much of the empirical research on IMI design consists of studies that focused on manipulating specific design features (e.g., highlighting text, or varying communication style) and evaluating their effects on learning outcomes. Based on this work, researchers have prescribed guidelines to use in the design of IMI (see Clark & Mayer, 2008). Mayer and his colleagues' indicated an effective instructional design reduces irrelevant information and helps learners to think more deeply about the training domain by addressing three design goals: (a) reducing extraneous cognitive processing, (b) managing essential cognitive processing, and (c) facilitating generative processing (Mayer, 2005). The features that are focused on extraneous cognitive processing are aimed to reduce distractions and make critical information stand out to learners. These design techniques are focused on selecting the right words and images, making sure critical ideas stand out, not overloading the learner, and following a logical use of visual space and training time. Applying these techniques likely helps learners better identify and learn relevant content. Features that help to manage essential cognitive processing focus on helping the learner to make sense of the information they are learning. This goal focuses on related principles that allow learners to pace their learning, make use of preexisting knowledge, and reduce attention conflicts within single sensory modalities (e.g., not presenting an animation with static text because both are within the visual modality). The final set of features relate to facilitating generative processing, and are intended to support learners in achieving a deeper understanding of the material they are learning. This third goal is to reduce as much as possible barriers to understanding by establishing an appropriate communication style with a learner (see Clark & Mayer, 2008; Mayer, 2009; Moreno & Mayer, 2007). These goals and techniques informed the review of existing IMI in the first phase of this research and when designing and developing IMI exemplars in the second phase.

PHASE I: REVIEW OF EXISTING ARMY IMI

In the first phase of this research, 179 examples of existing Combat Arms IMI were collected and reviewed. The examples were gathered from the Directorates of Training and Doctrine at the Maneuver Center of Excellence (Fort Benning, GA), the Fires Center of Excellence (Fort Sill, OK), and the Iowa National Guard Distributed Learning

Development Center (Camp Dodge, IA). Also reviewed were examples of IMI from the Army Knowledge Online My Training Tab (MT2) site.

The examples were initially evaluated for how relevant they would be for a new squad or team leader. Once the candidates for repurposing were identified, four key criteria guided our decisions: (a) whether source files were available, including uncompiled and editable files, (b) whether source materials were compatible with the software available to modify files, (c) whether the concepts, uniforms, equipment, and materials depicted were current, and (d) the instructional design characteristics of the existing IMI (e.g., content selection; quality of graphics, animation, text, and narration; navigation/organization). Initially, the plan was to redesign existing IMI to produce exemplars of needs-focused IMI. Ultimately, however, only 30% was amenable to being repurposed (see Blankenbeckler, Graves, & Wampler, 2013). Most of the existing IMI lacked source files that could be modified, or had been designed in superseded versions of software. In addition, much of the existing IMI was designed to focus on a general audience, lacking the details necessary to focus content on squad or team leaders' specific learning needs. While other organizations have reported similar difficulties reusing IMI, Shanley et al. (2009) have found that 25% of organizations who participated in their research reported a positive return on investment in terms of time, labor, or dollars from reusing IMI. However, the majority of organizations reported lower than expected returns, and 35% reported no savings or a loss.

PHASE II: DESIGNING AND DEVELOPING NEEDS-FOCUSED IMI

After reviewing existing IMI, two topics were identified around which to design six IMI exemplars. Given the emphasis of the MCOE initiative *Squad as the Foundation of the Decisive Force*, two topic domains were selected that would be relevant to new squad and team leaders in combat arms specialties (Maneuver Center of Excellence, N.D.). These two domains were: *Adjust Indirect Fire* (Task #061-283-6003) and *Conduct a Defense by a Squad* (Task #071-430-0002) (U.S. Army, 2008). Table 1 describes the six IMI exemplars in relation to the selected topic domains.

Table 1. Six Point of Need IMI Exemplars by Topic, Type of IMI, and Title

Topic	Type of IMI	Title
Adjust Indirect Fire (Task #061-283-6003)	Familiarization	Engaging Targets with Supporting Fires
	Core	Conduct Immediate Suppression
	Tailored Training	Adjust Indirect Fire
Conduct a Defense by a Squad (Task #071-430-0002)	Familiarization	Prepare Positions for Crew-Served Weapons During an Urban Operation
	Core	Designate and Prepare Urban Fighting Positions for a Javelin Team
	Tailored Training	Conduct a Defense by a Squad in an Urban Operation

Note: The tasks, conditions, and standards for the selected topics are documented in the *Soldier's Manual of Common Tasks, Warrior Leader Skills Level 2, 3, and 4* (U.S. Army, 2008).

Given that the target audience was new squad or team leaders (i.e., Specialist/Corporals, E-4, and Sergeants, E-5), it was anticipated that Conduct a Defense by a Squad would be more familiar to Soldiers, and Adjust Indirect Fire would be less familiar. Conduct a Defense by a Squad is a common task in which Soldiers at varying levels participate, even if they are not in the role of decision-makers or leaders. For similar reasons, it was anticipated that Adjust Indirect Fire would be less familiar given its complexity and more specialized training requirements.

The three types of training—familiarization, core/refresher, and tailored—were selected to cover a variety of training needs from preparation for a course, acquiring background knowledge to support more in-depth study, supporting execution of tasks on the job, etc. Familiarization and core/refresher training were not tailored, whereas the tailored training condition was designed to facilitate learners in selecting an individualized learning path. Familiarization training was intended to provide learners with an overview of the topic and resources to learn more, i.e., breadth of information. It would assist learners in gaining a modest understanding of the topic domain, but not a high-level of proficiency or expertise. Familiarization IMI was further intended for learners who need to be prepared for subsequent and more in depth learning, assisting them in forming a basic understanding of the content domain.

Core/refresher training was intended to provide only the essential information learners would need to perform a defined task, i.e., it provided depth of information, with less breadth. When designing core/refresher IMI, the model was 'how-to' manuals that present step-by-step how to execute a task. Again, given that the focus was on learners' immediate needs, they were not intended to reach a high-level of proficiency. Core/refresher IMI was designed for learners who would need immediate support in conducting on-the-job tasks or a quick refresher of a previously learned skill. This type of training would not lead to mastery of the task, as the core/refresher IMI contains no hands-on performance or sophisticated simulation.

Finally, tailored training combined both breadth and depth of information into multiple user-selected learning paths. It also included pre- and post-training diagnostic assessments with individualized feedback following each assessment. Feedback to learners was based on a pre-training diagnostic assessment. The feedback was intended to help learners identify content areas in which they were deficient and to select among the available learning paths. After learners completed training, they were again able to take a diagnostic assessment and receive feedback, with the option for additional training. The tailored training design was intended to meet a variety of learning needs. The diagnostic assessments were intended to help learners to be more aware of their specific learning needs and to make reasonable decisions on how to tailor their learning experience. While this approach to tailoring did not make use of cutting-edge technologies (such as computer-adaptive testing), it represented an effective and low-cost solution to enable tailored training in Army IMI.

In designing the IMI exemplars for the experiment, configurations of design principles were applied. One design feature shared across the different types of IMI was content chunking in terms of tasks and parts of tasks (see Figure 2).

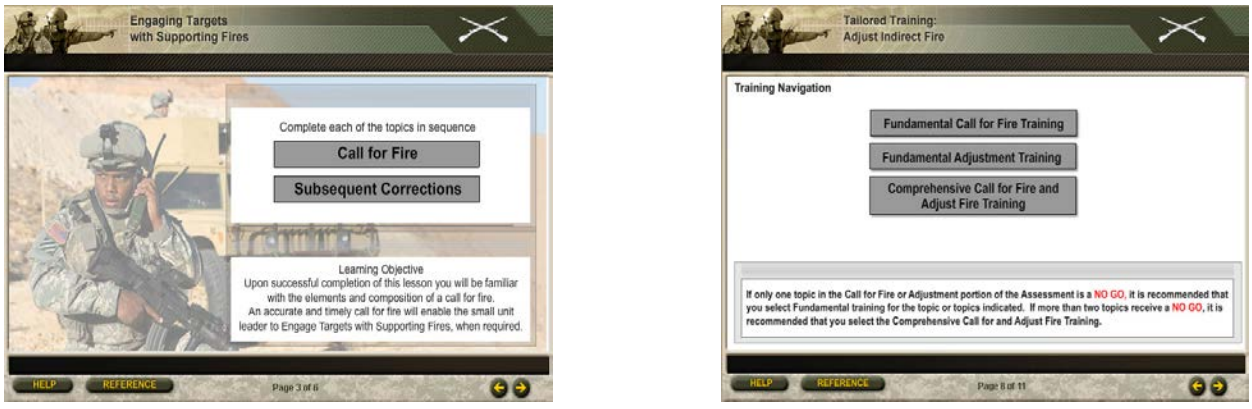

Figure 2. Examples of Content Chunking from Each Domain

Content chunking allowed us to present an organized structure to the learner up front as well as consolidate closely related material into manageable parts, helping to manage cognitive load (Sweller, 2005) and reduce extraneous processing (Mayer, 2005). This structure was intended to facilitate learners in navigating through the IMI, serving as way to organize content for the less knowledgeable Soldiers or as a road-map for the more knowledgeable. The assumption was that Soldiers could use their prior knowledge and experience to identify parts of the IMI that were particularly relevant to them.

Making sure the instruction had a narrative pattern, presenting a sequence of steps to interconnect parts of the tasks, was also important (Clark, 2005). This approach was particularly useful for the core/refresher variations of needs-focused IMI. For example, questions and feedback followed the sequence of an adjust fire mission to summarize the call for fire and Fire Direction Center (FDC) responses (see Figure 3).

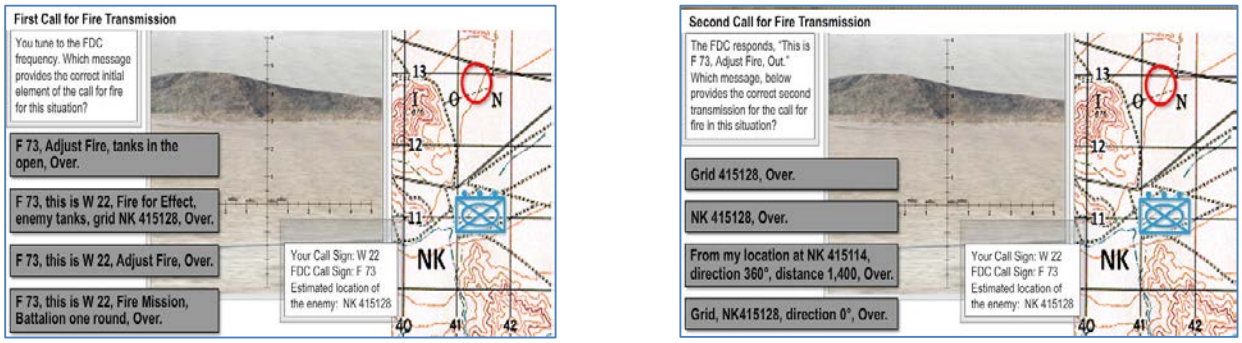

Figure 3. Example of Narrative Flow

Evaluation and feedback on specific task steps was also expected to help guide learners through the learning process, and served as a particular way of implementing narrative sequencing (see Figure 4). This approach helped learners to test their knowledge throughout the training and to maintain their focus on relevant content. This was viewed as an alternative way to approach to checks-on-learning that was intended to maintain focus on task execution. The learner was questioned and responded for each step in the task as it builds in complexity. Subsequently, they are presented feedback on their decisions between steps, building toward the complete task (van Merriënboer & Kester, 2005).

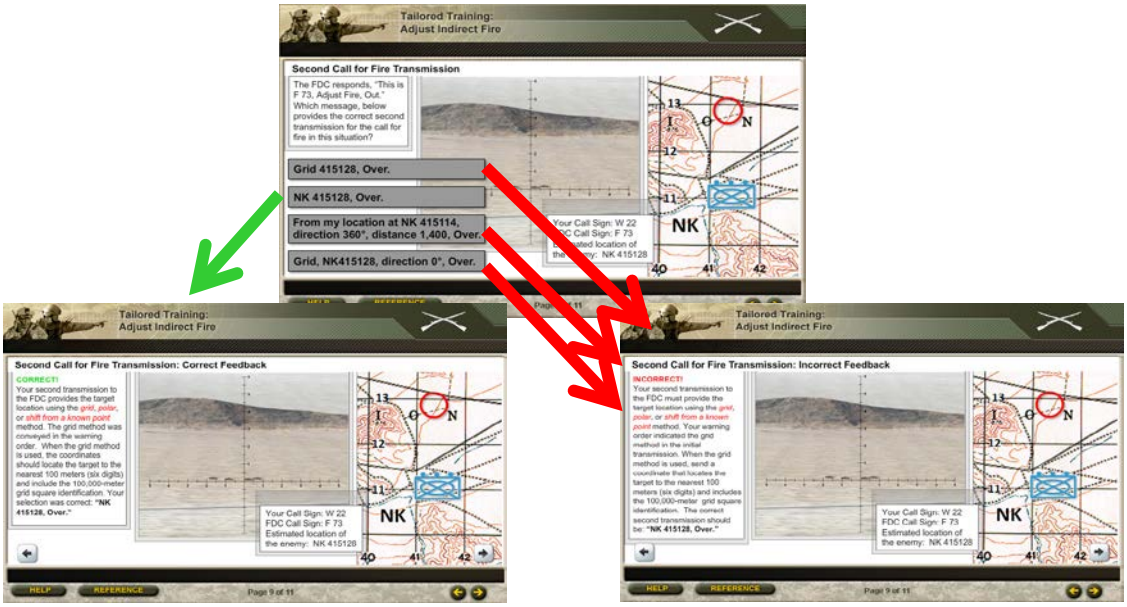

Figure 4. Example of Questions and Feedback on Individual Task Steps

Finally, the tailored training variation of needs-based IMI has some of its own unique features. For instance, whole task evaluation and feedback was unique to this variation. The tailored training IMI was designed with a diagnostic assessment at the start. This diagnostic was designed to measure prior knowledge learners had concerning the content domain, and then to provide feedback to learners on their deficiencies. It was structured such that learners would receive individualized feedback on particular content areas that they should focus on in training. Learners were allowed to select the content they wanted to look at, although they were given recommendations to optimize their self-selected learning path. Training recommendations were made in relation to the structure of chunked content within

the IMI, enabling learners to identify how to navigate through the content. This simple approach enabled us to adapt training to learners' needs without employing a complex learning management system, as the learner ultimately determined how they would proceed through the IMI. Once the IMI was complete, learners were again given an opportunity to test their knowledge and were provided with additional feedback to help guide their selection of future learning (see Figure 5).

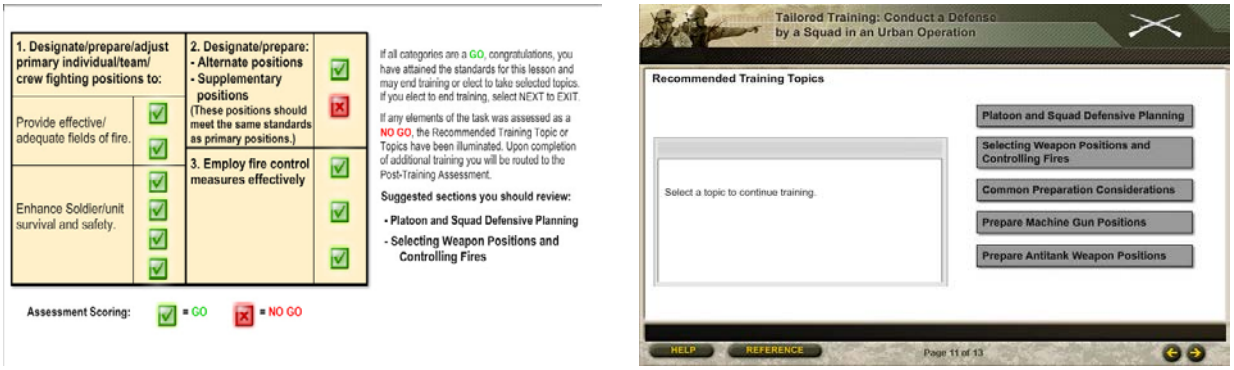

Figure 5. Example of Whole-Task Diagnostic Assessment and Feedback in Tailored Training Condition

PHASE III: EXPERIMENTAL EVALUATION OF THE IMI

Method

In the final phase of this research, the IMI were tested with $N = 91$ Soldiers enrolled in the WLC at the Henry Caro Noncommissioned Officer Academy at Fort Benning, GA. The experimental design was organized around two topics (i.e., more familiar vs. less familiar) and three types of needs-based IMI. These types were non-tailored (i.e., familiarization and core/refresher) and tailored training. The IMI were tested across six two-hour sessions, with all three IMI variations tested with different participants in each session. There were 15 to 19 WLC students who participated in each session. At the start of each session, Soldiers were briefed on the purpose of the research and administered informed consent. They were then asked to complete a short demographic questionnaire and to rate their familiarity with the training topic for that session, described broadly as either *Adjust Indirect Fire* or *Conduct a Defense by a Squad*. Based on their ratings, Soldiers were assigned to one of the three IMI conditions: familiarization (32%), core/refresher (32%), or tailored training (36%). Self-rated background knowledge was used to balance assignment of Soldiers to each group. Soldiers who participated were predominately Specialists (E-4; 67%), and most had deployment experience (75%). Some had experience with the relevant domains, with fewer having experience with Adjust Indirect Fire (16%) than with Conduct a Defense by a Squad (38%). Both Combat Arms (31%) and other MOSs (69%) were represented.

Once assigned to their training condition, each Soldier was administered a pretraining test for either *Adjust Indirect Fire* or *Conduct a Defense by a Squad*. Each topic has two test forms that were matched for content and difficulty. These forms were alternated between pre- and post-training (i.e., if a Soldier received Form A before training, he or she received Form B after training). Once their test was complete, it was turned in to a data collector, the time was recorded, and they were allowed to begin training with the IMI at their own pace. At the completion of training, Soldiers once again completed the alternate form of a knowledge assessment. Finally, Soldiers were asked to fill out a user evaluation of the IMI; a few of the Soldiers were briefly interviewed following the session.

Results

We hypothesized that all IMI conditions would improve Soldiers' performance, with tailored training showing the most benefit regardless of topic domain; additionally, we hypothesized that tailored training would most benefit Soldiers who were in the less familiar topic condition. To verify our assumption that Soldiers would have different background knowledge and experience with the respective topic domains, we looked at how Soldiers rated their prior knowledge (see Table 2). Conduct a Defense by a Squad ($M = 5.04$; $sd = 2.19$) rated higher than Adjust Indirect Fire ($M = 3.30$; $sd = 2.15$), $F(1, 89) = 14.73$, $p < 0.001$. This finding supported our initial assumption. Moreover, more

Soldiers indicated having prior experience with the Conduct a Defense by a Squad domain (38%) compared with Adjust Indirect Fire (16%), $X^2(N = 91) = 5.72$, $p = 0.017$. The IMI were designed to take roughly an equivalent time to complete, with an exception of the diagnostic testing in the tailored training condition. The amount of time that Soldiers spent on the training was roughly equivalent (M = 12 to 16 minutes; sd = 7 to 8 minutes) across conditions after subtracting the additional time for the diagnostic assessment in the tailored training condition (M = 15 to 18 minutes; sd = 3 to 5 minutes). The exception to this finding was for core/refresher training (M = 23 minutes; sd = 7 minutes) in the Conduct a Defense by a Squad condition, $\beta_{standardized} = 0.35$, $t = 2.49$, $p = 0.016$, *partial* $r = 0.35$. This core/refresher IMI was focused on preparing urban fighting positions for the Javelin missile team.

Table 2. Soldiers' Mean Scores by Training Topic and Type of Needs-Focused Training

Measures	**Adjust Indirect Fire (Mean)**			**Conduct a Defense (Mean)**		
	Fam	Core	Tailored	Fam	Core	Tailored
Rating of Prior Knowledge*	2.9	3.4	3.5	5.3	5.3	4.6
Training Time (Mean Minutes);	12m	16m	16m	16m	23m	16m
Embedded Assessment Time	--	--	18m	--	--	15m
Pretest Score (Mean % Items Correct)	39%	34%	48%	51%	51%	45%
Posttest (Mean % Items Correct)	47%	44%	66%	60%	63%	56%

*Note: The self-ratings of prior knowledge were scaled as '1 to 3' = 'None to Little', '4 to 6' = 'Moderate', and '7 to 9' = 'Extensive'.

Stepwise regression was used to examine the relationship between Soldiers' posttest scores (criterion) and their pretest scores, training time, type of needs-focused training they received, and their self-rating of prior knowledge for the more familiar (Conduct a Defense by a Squad) and less familiar (Adjust Indirect Fire) training topics. The overall models were significant for both Adjust Indirect Fire, $F(2, 41) = 33.9$, $p < 0.001$, and Conduct a Defense by a Squad, $F(1, 45) = 10.17$, $p = 0.003$. (The degrees of freedom for Conduct a Defense by a Squad were reduced because variables coding for differences among IMI types had no effect.) Pretest scores predicted posttest scores for both Adjust Indirect Fire ($\beta_{standardized} = .66$, $t = 6.36$, $p < 0.001$, *partial* $r = 0.61$) and Conduct a Defense by a Squad ($\beta_{standardized} = 0.43$, $t = 3.18$, $p < 0.003$, *partial* $r = 0.43$). All Soldiers improved their performance at posttest regardless of whether the training was on the more familiar or less familiar topic domain. A mean 12% point increase was found from pretest to posttest for Adjust Indirect Fire, and a mean 10.7% point increase for Conduct a Defense by a Squad.

A difference was found between types of needs-focused IMI for Adjust Indirect Fire (less familiar) topic domain. For the less familiar domain, tailored training was associated with higher posttest scores (i.e., 8 to 10 percentage points), over both familiarization and core/refresher training, $\beta_{standardized} = 0.25$, $t = 2.36$, $p = 0.023$, *partial* $r = 0.23$. However, there was no effect for training type for Conduct a Defense by a Squad, nor were self-ratings of prior knowledge associated with posttest scores for either content domain. Figure 6 summarizes the results.

DISCUSSION

This research surveyed existing Army IMI and selected examples to modify for three needs-based training formats, which were non-tailored—i.e., familiarization and core/refresher—and tailored training. Six IMI exemplars were developed and tested for two topic domains that were more and less familiar to new squad or team leaders. In past research, Dyer, Singh, and Clark (2005) found that Soldiers with less prior knowledge tended to benefit from having more structured training, and those who had more prior knowledge benefitted from being able to adapt training to their own needs. We designed our IMI to be flexible in providing both structure to guide learners as well as a means to be tailored to Soldiers' learning needs. The tailored training variation was the most comprehensive in terms of

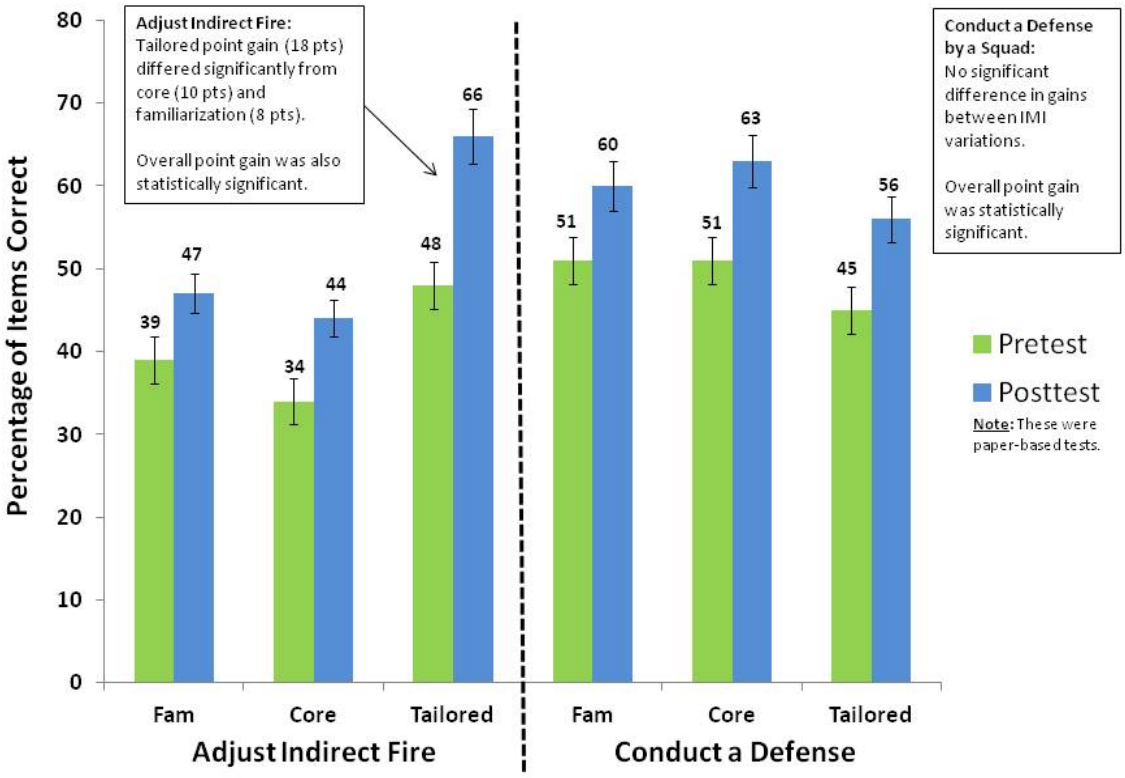

Figure 6. Pre and Post Test Scores by Content Domain and Training Type

the content and structure provided to support learners with less prior knowledge. We had hypothesized that Soldiers in both the more (Conduct a Defense by a Squad) and less (Adjust Indirect Fire) familiar topic conditions would benefit more from tailored training compared to those in the non-tailored familiarization and core/refresher IMI conditions. We also hypothesized that Soldiers in the less familiar topic condition would benefit more from tailored training than Soldiers in the more familiar topic condition.

Our learner-centered approach to tailoring was most beneficial to learners in the less familiar content domain, but it did not appear to impact learners negatively in the more familiar content domain. This finding was in accord with Dyer, Singh and Clark's (2005) earlier research. Among the many potential options available for developing tailored or adaptive training, the approach used here was intended to be a simple and straightforward way to incorporate tailoring techniques into needs-focused IMI.

In developing the IMI for this research, only 30% of the existing Army IMI review was reusable in the way intended. This finding suggests viable future research as Department of Defense has emphasized the need to reuse IMI across a variety of learning contexts (i.e., Sharable Content Object Reference Model; DoD, 2011). There are many excellent examples of Army IMI that demonstrate solid instructional design and application of learning science. However, few are currently configured for and are available in a format that facilitates modification and reuse to produce learning materials for different courses and audiences. When seeking to modify and reuse existing IMI, the researchers encountered a number of pitfalls. Often, source files were difficult to track down, the software in which the original IMI was designed was outdated, and uniforms, doctrine, etc., had sometimes changed. In order to reuse IMI, workarounds were often necessary. As an example, digitally recording audio and video off the My Training Tab (MT2) site allowed us to produce an editable file rather than attempting to modify incomplete or outdated source files. Unfortunately, trying to modify and reuse IMI in this way was more time consuming than if IMI had been developed from a cold start.

When developing IMI in the second phase of this research, configurations of design features were particularly useful for adapting content to individual learners' needs. For example, a hierarchical and chunked organizational structure

enabled users to quickly address a single topic in relation to other topics covered and to navigate through the IMI. Segmenting and presenting content in this way may also allow learners to take breaks and resume learning later with reduced disruption (Mayer, 2005). Many participants reported that being able to take a break from training and later resume it would be beneficial to them, given their many competing demands on the job.

Another feature of the IMI was the use of evaluation and feedback for each task step when teaching a task. This was similar to the usual checks-on-learning approach used by the Army, but it focused on the set of steps to execute a complete task. It was intended to support learners in developing a sequential understanding of the task, providing rationale for each step and how steps interrelate. In order to do this, the structure of task steps and decision process at each point was the central focus. This was a particularly straightforward approach for sequential tasks like Adjust Indirect Fire; however, it was more difficult when considering the multiple simultaneous subtasks and decision points in Conduct a Defense by a Squad. The Conduct a Defense by a Squad IMI modules required more articulated structures in order to capture the various narrative threads of the task and to address learners' particular needs. So, although the task was more familiar to Soldiers, it also required the IMI developed to be more complex in its design and selection of content.

Finally, a diagnostic assessment and individualized feedback in the tailored training condition was used to assist learners in identifying a path through the IMI that would be optimized for their learning needs. By providing detailed feedback to learners about the topic areas in which they had difficulty and allowing them to make self-aware decisions about how they would navigate the IMI, it was possible to apply tailored training principles in IMI without relying on a learning management system. While a learning management system is often required for certain types of adaptive training, the approach used in this research may allow for tailoring within even less complex and standalone types of IMI.

In the experimental test of the needs-focused IMI the results for Adjust Indirect Fire, which was the less familiar task, were as expected. In the Adjust Indirect Fire groups, all Soldiers improved performance, with Soldiers in the tailored training group showing much greater improvement over those in the non-tailored familiarization and core/refresher groups. However, the results for Conduct a Defense by a Squad did not follow this pattern. For Conduct a Defense by a Squad, all three needs-focused IMI conditions were associated with roughly equivalent improvement in test scores. One possible explanation for this difference between the Adjust Indirect Fire and Conduct a Defense by a Squad concerns the ways in which the Soldiers were navigating through the IMI. What seemed to be happening more frequently in the Conduct a Defense by a Squad group was that Soldiers tailored their learning experience by using the navigation scheme regardless of IMI condition. They seemed to be using the content headings and their own prior knowledge of the domain to track down novel information more quickly, navigating around—or quickly through—sections of content that were already familiar to them. With diagnostic testing and feedback, the tailored training for Adjust Indirect Fire may have provided a similar support to learners who were less knowledgeable. This support perhaps enabled them to better tailor their learning experience to their identified needs without having prior knowledge on which to rely. Another possible explanation concerns the relative complexity of the tasks. Adjust Indirect Fire, while a less familiar task, was also more sequential in structure than Conduct a Defense by a Squad. The particular ways in which the design features were implemented may have better supported learning of a more sequential and clearly structured task. Even so, additional research may be necessary to identify the precise mechanisms associated with this effect.

CONCLUSIONS

Continued research and innovation is essential concerning how to best develop IMI that can be modified and reused across different learning contexts and for different learning needs. The design features identified by this research provide a simple and effective means to apply tailored training techniques within IMI that do not require complex programming and high bandwidth features. This streamlined approach to needs-focused IMI design may be applicable for the Army and other branches of the military. When learners are less familiar with a topic domain, it may be useful to provide them with a clear navigational structure, including clearly labeled chunks of content, to supplement their understanding of the domain and enable them to select an appropriate learning path—i.e., tailoring their learning experience. Using diagnostic assessments with individualized feedback may further assist learners in discriminating between personally relevant and irrelevant content while learning, even if they do not yet have extensive domain knowledge. When learners are more familiar with a topic, the navigational structure appeared to assist them in seeking

novel information. In this regard, the information seeking behavior we observed was similar to what has been observed in other contexts when comparing novices to more knowledgeable learners (Kalyuga, 2005).

ACKNOWLEDGEMENTS

We appreciate the collegiality and support of the Maneuver Center of Excellence (MCoE) Directorate of Training and Doctrine (DOTD), Fort Benning, GA, during this research, in particular Mr. Edward B. Buckley, Ms. Lindsey L. Fredman, Mr. Chris Jaques, Mr. John Budd, Mr. Chuck Taylor, Mr. Jay A. Brimstin and Mr. James M. Morris. At the Fires Center of Excellent (FCoE) DOTD we thank Mr. Martin L. Huffmaster. At the Army National Guard Distributed Learning Development Center, Camp Dodge, IA, we thank COL Gregory O. Haygood, Jr., LTC Peter J. Quinn, CPT Jason T. Huffman, Ms. Danielle Orr, and Mr. Paul Outhier. Dr. Gary Rauchfuss (TRADOC Institute for Noncommissioned Officer Professional Development) and SGM Michael Coker also provided much needed information and assistance. Drs. Glenn Cobb, Jean Dyer, Peter Schaefer, and Scott Graham (U.S. Army Research Institute) provided valuable feedback and recommendations at critical points in this research effort.

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REPORT DOCUMENTATION PAGE

1. REPORT DATE (dd-mm-yy)	2. REPORT TYPE	3. DATES COVERED (from. . . to)
December 2014	Final	May 2012 – December 2014

4. TITLE AND SUBTITLE	5a. CONTRACT OR GRANT NUMBER
Tailoring Multimedia Instruction to Soldier Needs	W5J9CQ-11-D-0001
	5b. PROGRAM ELEMENT NUMBER: 633007

6. AUTHOR(S)	5c. PROJECT NUMBER
Thomas Rhett Graves (U. S. Army Research Institute) Paul N. Blankenbeckler and Richard L. Wampler (Northrop Grumman Corporation)	A792
	5d. TASK NUMBER: 359
	5e. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)	8. PERFORMING ORGANIZATION REPORT NUMBER
U.S. Army Research Institute 6000 6th Street Fort Belvoir, VA 22060-5610 Northrop Grumman Technical Services 3565 Macon Road Columbus, GA 31907	

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. MONITOR ACRONYM
U.S. Army Research Institute for the Behavioral & Social Sciences 6000 6th Street (Building 1464/Mail Stop 5610) Fort Belvoir, VA 22060-5610	ARI
	11. MONITOR REPORT NUMBER: Conference Paper

12. DISTRIBUTION/AVAILABILITY STATEMENT
Distribution Statement A: Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES
Contracting Officer's Representative and Subject Matter POC: Thomas Rhett Graves

14. ABSTRACT *(Maximum 200 words)*:
To address particular learning needs, instruction should be designed to provide the right information to the right learner at the right time. While interactive multimedia instruction can reach a large audience, different learners have different learning needs. In this research, three questions were addressed: (a) how could existing Army interactive multimedia instruction (IMI) be modified to a needs-based format, (b) what types of instructional design techniques could be applied to design IMI for learners' specific needs, and (c) what outcomes are associated with different types of needs-focused IMI? Following a survey of existing Combat Arms IMI, it appeared that most would require modification for reuse in a needs-based context. Six IMI exemplars were developed for two topics (i.e., Adjust Indirect Fire and Conduct a Defense by a Squad) targeting the learning needs of new squad or team leaders. The IMI were developed for three needs-focused conditions to test whether learners with differing levels of prior knowledge and experience performed better with different types of IMI. One condition was tailored training, and the other two were not tailored, and were designated as familiarization and core/refresher training. The exemplars were tested with Soldiers attending the Warrior Leader Course at Fort Benning. In all conditions, Soldiers showed higher test scores after training. However, for the less familiar topic, the greatest impact was found for the tailored training condition over non-tailored familiarization and core/refresher training. The familiar topic showed no differences among needs-based conditions. These results indicated that structure is necessary for novel material to mimic what learners naturally do with familiar material. To effectively modify IMI to a needs-based format, one needs to define the learning needs of the specific audience up front and to structure the IMI to support individual choice and flexibility.

15. SUBJECT TERMS
Point of Need Army Learning Model Army Learning Concept 2015 Interactive Multimedia Instruction
Tailored Training Multimedia Development

16. REPORT	17. ABSTRACT	18. THIS PAGE	19. LIMITATION OF ABSTRACT	20. NUMBER OF PAGES	21. RESPONSIBLE PERSON
Unclassified	Unclassified	Unclassified	Unlimited	12	Dr. Scott E. Graham 706-545-2362